Qualification Objectives

Master Intelligent Robotics

Faculty Applied Natural Sciences and Industrial Engineering

Deggendorf Institute of Technology

Authors:

Prof. Dr. Dmitrii Dobriborsci, director of the master's programme "Intelligent Robotics"

Stefanie Liegl, M.Sc, academic course assistant, Faculty NuW

Gender Neutrality

For maintaining readability and clarity, the use of double forms or other designations of female, male and diverse genders is largely avoided. All designations for the various groups ofuniversity employees refer equally to members of all genders of the groups concerned.

Last update: 15.02.2024

Contents

1 Course Objectives

The consecutive, application-oriented master's programme "Intelligent Robotics" (MIR) is to allow diploma or undergraduate students of Robotics, Autonomous Systems, Mechatronics, or closely related study fields to substantiate their current findings obtained with theoretical knowledge to meet the challenges of modern research and development tasks in particular.

This study programme complements undergraduate or diploma studies in-depth and moreover, broadens the knowledge base. Graduates thus are to be qualified for creative work in research and development departments. Particularly qualified students additionally are to acquire the theoreticalfundamentals required to pursue a doctoral programme or work in scientific fields.

2 Learning Outcomes of the Course

The study programme consists of three semesters and is completed by an independent scientific paper (master's thesis). The programme is module-based and encompasses three study semesters. In total, students can acquire 90 ECTS credit points. The learning outcomes of the individual modules including their detailed objectives as well as the knowledge, skills, and competencies to be acquired by the graduates are further described in the module handbook for the master's programme"Intelligent Robotics" at DIT. Within the modulehandbook, all modules are listed according to their respective module number of the study and examination regulations.

3 Study and Qualification Objectives

Professional and Methodological Competence

The international study programme is comprised of three semesters and is concluded with anindependent scientific thesis (master's thesis). This master's programme has a modular structure and consists of three theoretical semesters. Altogether, students can obtain 90 ECTS credit points.

The Master's degree program in Intelligent Robotics aims to develop a range of competences essential for success in the field. Students will acquire technical proficiency in robotics principles, programming languages, and tools such as ROS and embedded systems. They will cultivate problem-solving skills through hands-on projects and case studies, learning to analyze complex problems and devise effective solutions. The interdisciplinary nature of the program will provide students with a holistic understanding of robotics, integrating knowledge from areas such as control engineering, computer vision, and machine learning. They will develop critical thinking abilities, enabling them to evaluate existing technologies and methodologies and propose innovative approaches. Collaboration and communication skills will be honed through group work and collaborative projects, preparing students for interdisciplinary research and professional practice. Additionally, students will engage with ethical considerations and societal implications of robotics technologies, fostering ethical awareness and responsible innovation in their work. Through projects and the master's thesis, students will have opportunities to contribute to the advancement of knowledge in the field and address real-world challenges in intelligent robotics.

This master's programme is to qualify students for scientifically founded engineering work, amongst others, in the following fields:

- Development and application of robotics solutions in the following areas:
    - Manufacturing
    - Agriculture
    - logistics
    - etc.
- Lead and management of technical projects
- Industrial automation
- Human-robot interaction
- Service robots

- Implementation of robotics in digital manufacturing processes, enhancing production control and efficiency through automation and smart manufacturing technologies.
- Research and teaching

The master's thesis and the master's seminar account for students' ability to independently apply the skills and knowledge gained within the study course to complex tasks and to present those bywriting and speaking in an appropriate form. By this way, students prove that they have acquired the ability for independent scientific work. The skills acquired found the basis for pursuing further studies, i.e., a doctoral degree in Production Technology or a related subject area.

Social and Personal Competence

The master's programme "Intelligent Robotics" fosters social competence, communication, and presentation skills. Upon entry into professional life, the high level of practical relevance prepares students for socialisation and operational as well as scientific work environments. In addition to technical and methodological knowledge, corresponding management techniques as well as social competencies are equally conveyed.

The case studies integrated not only promote technical skills but also foster personal and social competencies. The case studies offer the ideal opportunity to apply theoretical knowledge gained from the respective modules into practice. Small student groups deal with individual scenarios.In the process, different solution approaches collide, which demands discussion to find a practical solution within the group eventually. Decision-making competencies are equally trained. Moreover, these case studies offer students the opportunity to consider problems from different angles. Theoretical knowledge relates to the analyses elaborated to understand and explain the respective scenario.

The case studies also prepare students ideally for their everyday working life by collaborating within a team. A group presentation on the findings obtained is also part of the case studies. Graduates of the master's programme "Intelligent Robotics" are skilled to present work resultsin a structured manner and to further discuss their findings in front of an expert audience. Furthermore, graduates are qualified to organise themselves independently and to demonstrate team skills as well as high leadership competence for interdisciplinary collaboration.

4 Learning Outcomes of the Modules / Module Objectives /Target Matrix

The individual modules, their adherent detailed objectives and the competencies graduates need to acquire are further described in the module handbook. The following table establishes the link between the individual modules and the objectives of the master's programme described in the previous section.

Target Matrix of the Modules within the Master's Programme "Intelligent Robotics"

Module	Objectives											
	Knowledge				Skills				Competencies			
	Scientific / Technical	Engineering Methodology	Engineering Practice and Product Development	Interdisciplinary	Scientific / Technical Fundamentals	Engineering Methodology	Engineering Practice and Product Development	Interdisciplinary	Scientific / Technical Fundamentals	Engineering Methodology	Engineering Practice and Product Development	Interdisciplinary
Module MIR-1 Robot Dynamics	xx	x	xx		x	x	xx		x	x	xx	
Module MIR-2 Advanced Methods in Control Engineering	x	x	xx			x	xx			x	xx	
Module MIR-3 Statistics and Machine Learning			xx				xx	xx			xx	
Module MIR-4 Technical Project Management		xx	x			xx	x			xx	x	
Module MIR-5 Embedded Systems		xx	xx			xx	xx			xx	xx	
Module MIR-6 Case Study ROS Robot Programming			xx	xx			xx	xx		xx	xx	xx
Module MIR-7 Advanced Methods in Robotics	x	xx	xx		x	xx	xx		x	xx	xx	
Module MIR-8 Image-Processing and Computer Vision		xx	xx			xx	xx			xx	xx	
Module MIR-9 Robot-Modelling & Simulation			xx	xx			xx	xx			xx	xx
Module MIR-10 Industrial Robotics & Automation		xx	xx			xx	xx			xx	xx	
Module MIR-11 Case Study Robotic Systems			xx	xx			xx	xx			xx	xx
Module MIR-12 Intelligent Multi-Agent Systems	x	xx	xx		x	xx	xx		x	xx	xx	
Module MIR-13 Subject-Related Elective Course (FWP)		x	xx	x		x	xx	x		x	xx	x
Interdisciplinary Area												
Module MIR-14 Master's Module			xx	xx			xx	xx			xx	xx

Key: xx strong reference; x intermediate reference